AMENDMENTS TO THE DRAWINGS

The attached sheets of drawings includes changes to Figs. 2 and 15. These sheets replace the original sheets including Figs. 2 and 15. In Figs. 2 and 15, the label "Prior Art" has been added.

Attached: Replacement Sheets
Annotated Sheets Showings Changes.

REMARKS/ARGUMENTS

Reconsideration and allowance of this application are respectfully requested. Currently, claims 1-11 and 13-24 are pending in this application.

Objections to the Drawings:

The drawings were objected to because "Figures 2 and 15 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated." By this Amendment, Figs. 2 and 15 have each been amended to include the legend --Prior Art--. Applicant therefore requests that the objections to the drawings be withdrawn.

Objections to the Claims:

Claims 3, 5 and 6 were objected to because of informalities. By this Amendment, claims 3 and 5 have been amended in accordance with the Examiner's helpful suggestions. Claim 6 has been amended so that it depends from independent base claim 1. That is, the above-noted claim amendments clarify that claim 6 is not an independent claim. Applicant therefore requests that the objections to the claims be withdrawn.

Rejection Under 35 U.S.C. §101:

Claims 1-11 were rejected under 35 U.S.C. §101 as allegedly being directed to non-statutory subject matter. By this Amendment, independent base claim 1 has been amended to make even further certain that the invention recited therein is "tied" to a machine (i.e., tied to another statutory category specifically enumerated by 35 U.S.C. §101). Namely, claim 1 has been amended so that the invention is "tied" to one or more computer processing systems (i.e., tied to a machine). Applicant therefore requests that the rejection under 35 U.S.C. §101 be withdrawn.

<u>Rejection under 35 U.S.C. §102 and 103</u>:

Claims 1-4 and 12-17 were rejected under 35 U.S.C. §102 as allegedly being anticipated by Subramaniyan et al. (U.S. '134 hereinafter "Subramaniyan"). Applicant traverses this rejection.

Anticipation under Section 102 of the Patent Act requires that a prior art reference disclose every claim element of the claimed invention. See, e.g., *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.,* 806 F.2d 1565, 1574 (Fed. Cir. 1986). Subramaniyan fails to disclose every claim element of the claimed invention. For example, Subramaniyan fails to disclose "b) determining, using the one or more computer processing systems, one or more further motion estimations representative of the global motion between the particular frame and its anchor frame at least partially on the basis of motion vectors between the particular frame and one or more preceding or succeeding other frames; and c) selecting, using the one or more computer processing systems, one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the frame," as required by independent claim 1 and its dependents.

Similarly, Subramaniyan also fails to disclose "video processing means arranged in use to:...ii) determine one or more further motion estimations representative of the global motion between the particular frame and its anchor frame at least partially on the basis of motion vectors between the particular frame and one or more preceding or succeeding other frames; and a motion estimation selector means arranged in use to select one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the frame," as required by independent claim 14 and its dependents.

Estimation of global motion using macroblock motion vectors present within encoded video is an important tool in image registration. However, noise present in motion vector information can lead to erroneous results. Claims 1 and 14 provide a method and system which reduce the impact of such noise by calculating motion estimations along two different routes from the anchor frame to the frame in question.

The subject matter of Subramaniyan is summarized at paragraph [0013], as follows:

> *"[a] method and apparatus for determining the quality of a block match for a candidate motion vector in a video encoder system using motion vectors representing the difference in coordinates of a macroblock of data in a current frame of video data and coordinates of a related macroblock of data in a reference frame of video data."*

Subramaniyan discloses finding motion vectors (i.e., indicating matching blocks in different frames of a video sequenced) when encoding video. As with most video coding standards in use today, such as H.26x and MPEG-X, Subramaniyan describes motion vectors coded relative to a predicted motion vector (PMV). In early standards, the PMV was simply the vector used to code the macroblock to the left of the current macroblock, but has evolved to more complex functions of previously encoded vectors. The more similar a motion vector is to the PMV, the less bits are generally needed to encode it.

Subramaniyan continues at paragraph [0013] to clarify that the quality of a block match is determined by searching blocks in a region of a frame adjacent to a first block identified as a first estimate best match (as illustrated in Figures 3 and 5). At paragraph [0038], Figure 3 is described as showing a sample search pattern around each motion vector predictor (MVP). Subramaniyan uses a similar term "motion vector predictor" to indicate a start position in a previous frame for searching for motion vectors.

Subramaniyan describes generating a comparison between a block in the current frame with blocks in a previous frame, in which each block in the previous frame is identified by means of a motion vector (MV), the MV indicating the offset between the position of the block in the current frame and the position of the block in the previous frame.

As noted above, independent claim 1 (similar comments apply to claim 14) requires, among other things, *"b) determining, using the one or more computer processing systems, one or more further motion estimations representative of the global motion between the particular frame and its anchor frame at least partially on the basis of motion vectors between the particular frame and one or more preceding or succeeding other frames."* Part (b) of claim 1 thus determines global motion information for a frame using a different set of motion vectors to that used in part (a), which constitutes a method of determining a single value of global motion information using a set of motion vectors for a frame. Part (b) of claim 1 is not disclosed by Subramaniyan.

Page 5 of the Office Action apparently alleges that paragraph [0035] of Subramaniyan discloses part (b) of claim 1. Applicant disagrees with this allegation. Paragraph [0035] of Subramaniyan states the following:

> [0035] Thus, the motion estimation circuit 110 can determine the global motion vector by using an average of all final motion vectors in a previous frame for which a difference metric is below a specified threshold. In particular, the motion estimation circuit 110 can determine the global motion vector by calculating a difference metric for each of final motion vectors in a previous frame, comparing the difference metric for each of the final motion vectors in the previous frame with a predetermined threshold, and determining the global motion vector based on the each of the final motion vectors in a previous frame with a difference metric that is below the threshold.

Paragraph [0035] of Subramaniyan describes using the "final" motion vectors for a picture, i.e. the motion vectors selected by the search process described in Subramaniyan and

then encoded into the bitstream, to generate global motion parameters. This is part of the prior art, as cited in the originally-filed specification. This description quotes a number of disclosures of using encoded motion vectors to derive a <u>single</u> global motion value for a frame (see references to Meng, Tan, Pilu, Jones and Smolic at page 5, line 1 to page 7, line 2).

Page 5 of the Office Action also refers to paragraph [0026] in connection with part (b) of claim 1. Paragraph [0026] of Subramaniyan states the following:

> "[0026] In operation, <u>*motion estimation is computed for blocks of image data from a current image frame*</u> using one or more previously processed image frames. The motion estimation circuit 110 outputs a motion vector corresponding to a processed block. The motion compensation circuit 115 forms a prediction block from the previous frame using the computed motion vectors. A difference image is computed by the adder 120 by subtracting the predicted image data from the current image frame. This difference image is transformed using the DCT circuit 125. Whereas the motion estimation circuit 110 and the motion compensation circuit 115 serve to reduce the temporal redundancy between image frames, the DCT circuit 125 serves to reduce the spatial redundancy within a frame. The DCT coefficients are subsequently are subject to reduced precision by the quantizer 140. The quantizer 140 increases compression while introducing numerical loss. The quantized DCT coefficients are then encoded by the VLC encoder 135 and transmitted in a compressed video bitstream along with the motion vectors. The local reconstruction loop is comprised of the inverse quantizer 140, the IDCT 145, and the adder 150. The inverse quantizer 140 reconstructs the DCT coefficients. The IDCT 145 transforms the DCT coefficients back into the spatial domain to form a quantized difference image. The reconstructed frame is computed by the adder 150 by adding the motion compensated data to the quantized difference image. This reconstructed data is then stored in the previous frame circuit 155 for use in processing subsequent image frames (emphasis added)."

As can be seen from above, paragraph [0026] of Subramaniyan concerns motion estimation for <u>blocks</u> of image data: i.e. ordinary, block-oriented motion vectors <u>not</u> global motion vectors. Here, Subramaniyan describes the conventional bi-directional or B frame, the blocks of which are coded with two reference frames, one in the past and one in the future in the

video sequence. The invention of claim 1 does not involve encoding blocks of a B frame but a generally applicable method for calculating global motion vectors for a frame.

Independent claim 1 further requires, *"c) selecting, using the one or more computer processing systems, one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the frame."* Part (c) of claim 1 thus relates to selecting between the different global motion values derived in parts (a) and (b) of claim 1. Since Subramaniyan only describes generating a *single* global motion value, no selection between alternative values is possible.

Page 5 of the Office Action refers to paragraph [0050] of Subramaniyan as allegedly providing criteria for selection. However, this is part of the second stage of selecting the best MV for a macroblock (see paragraph [0054]). Subramaniyan does not describe a selection process for alternative global motion vectors as set out in part (c) of claim 1. Similar comments apply to claim 14.

Claims 6-9 were rejected under 35 U.S.C. §102 as allegedly being anticipated by Jinzenji (U.S. '664, hereinafter "Jinzenji"). Claims 5 and 18 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Subramaniyan in view of Lee et al. (U.S. '568, hereinafter "Lee"). Claims 10-11 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Jinzenji in view of Szeliski et al. (U.S. '918, hereinafter "Szeliski"). Claims 19-22 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Subramaniyan in view of Jinzenji. Claims 23-24 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Subramaniyan in view of Jinzenji, and further in view of Szeliski. Each of these claims now depends either directly or indirectly from base independent claim 1 or 14. None of the above-noted additional references (Jinzenji, Lee and/or Szeliski) resolves the above-described

deficiencies with respect to Subramaniyan. Applicant therefore respectfully requests that each of these rejections under 35 U.S.C. §102 or §103 be withdrawn.

Double Patenting Rejection:

Claims 6-11 were provisionally rejected on the ground of non-statutory obviousness-type double patenting as allegedly being unpatentable over claims 11-16 of co-pending Application No. 10/535,621. Attached hereto is a timely filed Terminal Disclaimer. Applicant therefore respectfully requests that the provisional rejection on the ground of non-statutory obviousness-type double patenting over co-pending Application No. 10/535,621 be withdrawn.

Conclusion:

Applicant believes that this entire application is in condition for allowance and respectfully requests a notice to this effect. If the Examiner has any questions or believes that an interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

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